International Competitiveness of the Chinese Apples Industry: A Comparison of Six Countries

Zhang Min

I   Introduction

Apple is one of the most widely produced fruits in the world. Today, there are more than 7500 apple varieties around the world planted in different climate conditions, which were cultivated in 91 countries covering about 13 million acres. Overall world apple production increased by over 13 million MT (or about 23 percent) between 1999 and 2009. By 2010, world apple production was 71.3 million MT (FAO[1]). 44% of this quantity is produced by China, 6% by the United States, 4% by Poland, 3% by Italy, and 3% by France. The long-term trend in world apple production continues upwards and it is predicted that production in 2015 is 32.5 percent higher than in 2000 (Belrose[2]). Moreover, almost all of that increase can be attributed to the increase in China over the past ten years (Figure 1).

China has gained immerse influence on the global apple situation because of the absolute volume of apples in the last decade. Between 1999 and 2009, total Chinese apple production increased by over 10 million MT, or by approximately 52 percent. It now consistently produces over 40 percent of the world total. China is also the world's largest apple exporter by volume, even though exports accounted for only 4 percent of domestic apple production in 2009. Since 2003, China's apple exports volumes have surpassed those of the United States and have made inroads into major U.S. export markets in the ASEAN market (Huang and Gale[3]). However, the value of China's fresh apple exports was lower than those of the United States, France, Italy, and Chile before 2007, and took second place behind the United States in 2009.

Given the intense global competition in the apple industry between China and other major apple producing countries, it is crucial to understand the current status, competitiveness, and challenges of the Chinese apple industry. The general objective of this study is to estimate the export trends of the Chinese apple industry during the period from 1999 to 2009, and explain to what extent China's apple industry is capable to compete in the international market with other major apple producing countries through estimating their MS index, RCA index, and TC index.

**Figure 1** Apple Production in the World and Selected Countries, 1999–2009
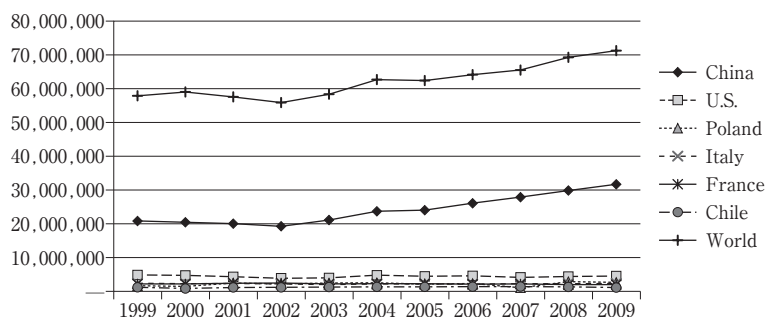
Source: FAOSTAT

The paper is organized as follows. Section 2 provides an overview of the Chinese apple industry, including apple production and trade in the international market. Section 3 describes the methodology and data used in the competitiveness analysis, and then presents the results of China's apple competitiveness compared to other leading countries over the past ten years. Section 4 analyzes the factors that affecting the competitiveness of the Chinese apple industry. Section 5 provides concluding remarks.

II Overview of Apple Production and Trade in China

Between 1990 and 2009, China's apple production increased 637 percent. By 2009, the country produced 31.68 million MT of apples from 2.05 million hectares, representing 44.5% of global production and 41.64% of the world's area planted in apples (FAO)[1]. Despite the tremendous increase in production, total Chinese apple acreage actually decreased between 1999 and 2009, falling from 2.44 million hectares in 1999 to 2.05 million hectares in 2009 (Figure 2). While total acreage declined slightly, yields grew significantly as growers began implementing improved orchard method and planted more high-density orchards. In 2006, the production of apples in China achieved a yield of 135,910 Hg per hectare and yields surpassed the world average, but still significantly below the yields of the major apple producing countries. In 2009, apple yields in China reached 154,593 Hg per hectare, or about 40 percent of the average yield in Italy and France, and 50 percent of the average yield in the U.S. and Chile (FAO)[1].

As the world's largest apple producer, China also has boosted its exports of apples. China's exports and imports of fresh apples increased dramatically in the past ten years, and apples exports are rising faster than its imports. Exports of fresh apples increased 434.5 percent from 219,235 MT in 1999 to 1,171,822 MT in 2009. Imports of fresh apples increased by 53 percent from 1999 (164,060 MT) to 2009 (177,107 MT). Meanwhile, the value of exports in fresh apples rose by a dramatic 837.5 percent, going from $75 million in 1999 to $712 million in 2009, still falling behind the United States (FAO)[1].

Figure 2　Apple Production and Harvested Area in China, 1999-2009
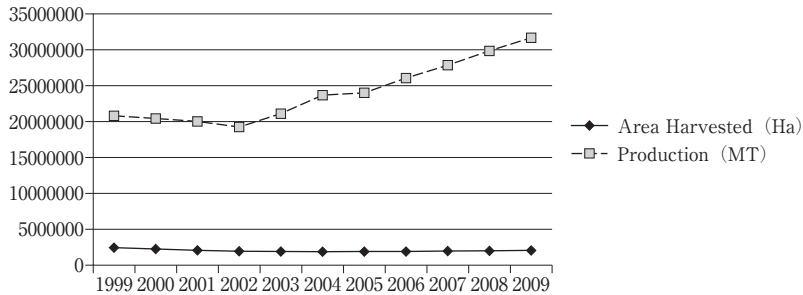
Source: FAOSTAT

III　Methodology for Competitive Analysis and Results

This paper adopts the commonly accepted indices to reflect the relative competitiveness of the Chinese apple industry based on long-term trade data by comparing other selected countries, that is, the United States, Italy, France, Chile, and Poland. Data source included the Food and Agriculture Organization（FAO）Database, the United Nationals Commodity Trade Database, the Foreign Agriculture Service（FAS）Database of USDA, and the China National Bureau of Statistics（CNSB）. This study focuses on the exports and imports of fresh apples and defines fresh apples according to the Harmonized Commodity Description and Coding System（HS）of the Customs Cooperation Council（HS Code of fresh apples is 08081000）.

（1）　Market Share（MS）

Comparative advantage can be measured by market share to identify size advantage and degree of specialization in the market. Market share is the proportion of the total available market or market segment being captured by a country. It can be expressed by the following equation:

$$MS_{ij} = \frac{X_{ij}}{X_{wj}}$$

Where

　　MS_{ij} = market share of commodity j by country j

　　X_{ij}　= exports of commodity j from country j

　　X_{wj} = world exports of commodity j

Table 1 and Table 2 shows the market share of fresh apples in selected countries from 1999 to 2009. China has exhibited an impressive expansion in exports, and kept an upward trend in market share from 2.91% in 1999 to 12.90% in 2009 by export value and from 4.13% in 1999 to 15.11% in 2009 by export quantity. France's market share showed a declining trend from 18.82% in 2002 to 10.69% in 2009 by export quantity and from 16.07 in 2000 to 7.88% in 2009 by export value. The U.S. market share dropped from 17% in

Table 1 Market Share by Export Value（1000 $）in Selected Countries, 1999-2009

	U.S.	China	Italy	France	Chile	Poland
1999	14.27%	2.91%	10.38%	16.07%	8.79%	1.15%
2000	17.00%	4.23%	10.63%	18.66%	7.96%	1.41%
2001	17.00%	4.16%	10.49%	18.72%	9.75%	1.14%
2002	13.17%	5.19%	12.79%	18.82%	9.69%	1.72%
2003	10.65%	6.13%	13.69%	17.88%	7.75%	1.97%
2004	10.04%	7.18%	11.33%	15.04%	8.84%	2.64%
2005	12.85%	7.88%	12.41%	13.04%	7.81%	3.05%
2006	12.57%	8.53%	12.87%	13.10%	8.73%	2.75%
2007	11.84%	9.33%	13.59%	12.38%	10.04%	3.20%
2008	12.04%	11.22%	13.19%	12.39%	8.96%	3.08%
2009	13.80%	12.90%	12.08%	10.69%	9.01%	5.08%

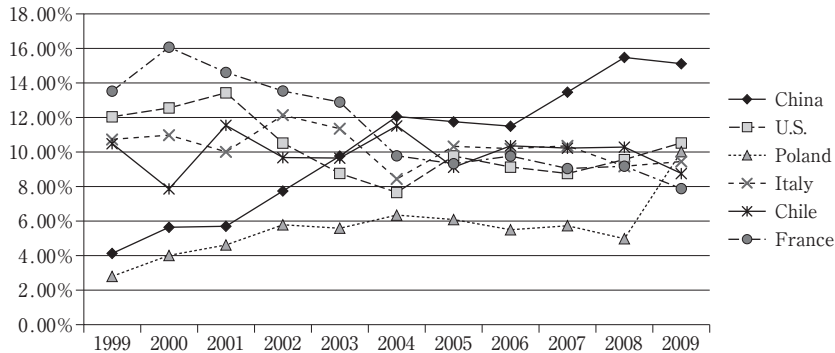Source: Calculated by author from FAOSTAT

Table 2 Market Share by Export Quantity（MT）in Selected Countries, 1999-2009

	China	U.S.	Poland	Italy	Chile	France
1999	4.13%	12.04%	2.80%	10.72%	10.48%	13.52%
2000	5.64%	12.55%	4.01%	10.97%	7.86%	16.07%
2001	5.70%	13.42%	4.62%	10.01%	11.54%	14.60%
2002	7.74%	10.52%	5.78%	12.13%	9.67%	13.53%
2003	9.77%	8.76%	5.59%	11.35%	9.64%	12.89%
2004	12.05%	7.66%	6.34%	8.44%	11.51%	9.78%
2005	11.75%	9.77%	6.09%	10.32%	9.12%	9.32%
2006	11.49%	9.12%	5.50%	10.19%	10.36%	9.76%
2007	13.46%	8.75%	5.73%	10.36%	10.22%	9.04%
2008	15.47%	9.56%	4.98%	9.17%	10.28%	9.18%
2009	15.11%	10.52%	10.02%	9.45%	8.75%	7.88%

Source: Calculated by author from FAOSTAT

Figure 3 Trends of Market Share by Export Value（$1,000）in Selected Countries, 1999-2009
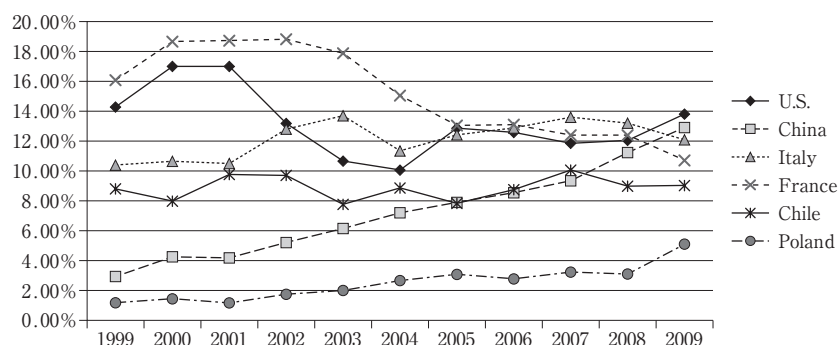
Source: Calculated by author from FAOSTAT

Figure 4 Trends of Market Share by Export Quantity (Tons) in Selected Countries, 1999-2009

Source: Calculated by author from FAOSTAT

2000 to 13.80% in 2009 by export quantity and from 13.42% in 2001 to 11.52% in 2009 by export value.

However, those two counties still get big share and have a strong competitiveness in the global apple market. Poland has been the largest European producer of apples in some recent years and thus showed a tendency to increase in market share. Especially, the market share by export quantity expanded significantly from 4.98% in 2008 to 10.52% in 2009. Chile is the main international apple exporter in spite of its low contribution to world apple production with 2%, its share in apple world exports is 9% both by quantity and value. Overall, market share gap between the major apple producing countries is getting smaller from 1999 to 2009. Correspondingly, competition among them is becoming more and more fiercely (Figure 3 and Figure 4).

(2) Revealed Comparative Advantage (RCA)

Balassa[4] introduced the Revealed Comparative Advantage (RCA) index to measure the international trade competitiveness. The RCA index is defined as follows.

$$RCA_{ij} = \frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}}$$

Where

RCA_{ij} = revealed comparativa advantage of commodity j from country i

X_{ij} = export value of commodity j in country i

X_{it} = total export value in country i

X_{wj} = export value of commodity j in the world

X_{wt} = total export value in the world

The RCA index shows the extent of commodity specialization in a country's exports relative to the share of that commodity in world exports. When the RCA index of a country has a value greater than 1, this means that the share of that commodity in the country's exports is higher than the world's average. Moreover, if RCA>2.5 means an extremely strong comparative advantage; 1.25<RCA<2.5 means a strong comparative advantage; 0.8<RCA<1.25 means a moderate comparative advantage; RCA ⟨0.8 means a weak com-

Table 3 RCA Index in Selected Countries, 1999–2009

	Chile	Poland	Italy	France	U.S.	China
1999	29.25	2.40	2.52	2.82	1.17	0.85
2000	26.75	2.87	2.85	3.68	1.40	1.10
2001	33.04	1.96	2.66	3.58	1.44	0.97
2002	34.60	2.71	3.26	3.68	1.23	1.03
2003	27.13	2.78	3.47	3.46	1.11	1.06
2004	25.07	3.24	2.95	3.07	1.14	1.12
2005	19.85	3.58	3.49	2.95	1.50	1.08
2006	18.03	3.00	3.74	3.20	1.48	1.07
2007	20.69	3.20	3.81	3.10	1.44	1.07
2008	21.81	2.91	3.92	3.24	1.51	1.26
2009	20.88	4.66	3.71	2.76	1.64	1.34
Average	25.19	3.03	3.31	3.23	1.37	1.09

Source: Calculated by author from FAOSTAT

Figure 5 Trends of RCA in Selected Countries, 1999–2009
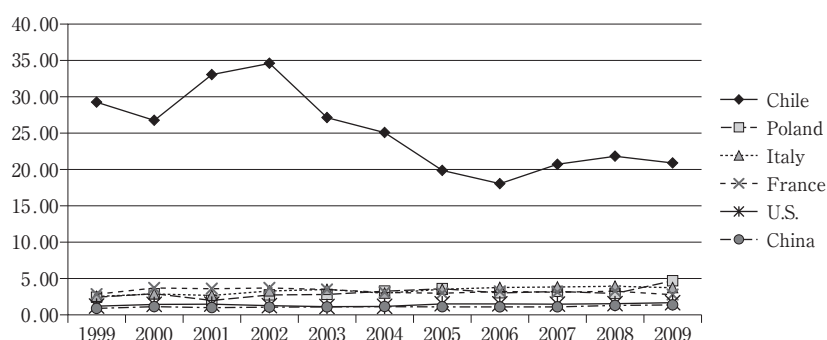
Source: Calculated by author from FAOSTAT

parative advantage.

Table 3 describes the RCA index values calculated for fresh apples in selected countries between 1999 and 2009. Although the RCA index shows a downward trend, Chile still has an extremely strong comparative advantage with its average RCA index of 25.19. Poland, Italy, and France showed a strong comparative advantage with the average RCA of about 3. China and the United States are two countries that experienced a transition from a moderate comparative advantage to a strong comparative advantage. The average RCA index of the Chinese apple industry is 1.09 from 1999 to 2009, which means that the share of apples exports in China's total exports was slightly above the world's average. Although the RCA index displays an upward trend, China has a strong comparative advantage until 2008 and falls behind other five selected countries during this period (Figure 5).

（3）Trade competitiveness（TC）

It has been argued that the RCA index is biased because of the omission of imports es-

Table 4　TC Index in Selected Countries, 1999-2009

	Chile	Poland	Italy	France	U.S.	China
1999	1.00	0.40	0.84	0.72	0.47	-0.11
2000	1.00	0.63	0.84	0.81	0.55	0.01
2001	1.00	0.44	0.82	0.76	0.56	0.02
2002	1.00	0.87	0.81	0.74	0.56	0.24
2003	1.00	0.84	0.82	0.74	0.38	0.36
2004	1.00	0.89	0.70	0.54	0.28	0.39
2005	1.00	0.87	0.84	0.58	0.60	0.41
2006	1.00	0.78	0.89	0.65	0.55	0.49
2007	1.00	0.51	0.90	0.60	0.51	0.38
2008	1.00	0.65	0.88	0.67	0.62	0.47
2009	1.00	0.90	0.91	0.64	0.64	0.60
Average	1.00	0.71	0.84	0.68	0.52	0.30

Source: Calculated by author from FAOSTAT

pecially when country size is important（Greenaway and Milner[5]）. Thus, as a relative index, trade competitiveness expresses whether country i has net export or import, reducing the distortion effect of macroeconomic fluctuations such as inflation. The TC index is calculated as follows.

$$TC_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}}$$

Where

　　TC_{ij} = trade competitiveness of commodity j from country i

　　X_{ij}　= exports value of commodity j in country i

　　M_{ij}　= import value of commodity　j in country i

　The index ratio ranges from -1 to 1. If TC>0, it means the productivity of commodity j in country i is higher than the world average level. To the world market, country i is a net export one on commodity j, and it has the trade competitive advantage, when the value is larger, and the advantage is more significant. If TC<0, it means the productivity of commodity j in country i is lower than the world average level. To the world market, country i is a net import one on commodity j and it has the trade competitive disadvantage, when the absolute value is larger, the disadvantage is more significant. If TC=0, it means the productivity of commodity j in country i is equal to the world average level.

　Table 4 reports the TC index values calculated for fresh apples in selected countries between 1999 and 2009. TC index also indicated that Chile have an extremely strong international competitiveness with the TC index of 1 during this period. The TC index of 1 means almost all apple production is targeted at the export market. Poland increased greatly the competitiveness from the TC index of 0.40 in 1999 to 0.90 in 2009, but the TC index showed a fluctuating tendency of increasing competitiveness from 1999 to 2009（Figure 6）. Italy and the United States showed a strong competitive advantage and kept a slight upward trend over the period, whose average TC index are 0.84 and 0.52 respec-

Figure 6　Trends of TC in Selected Countries, 1999-2009
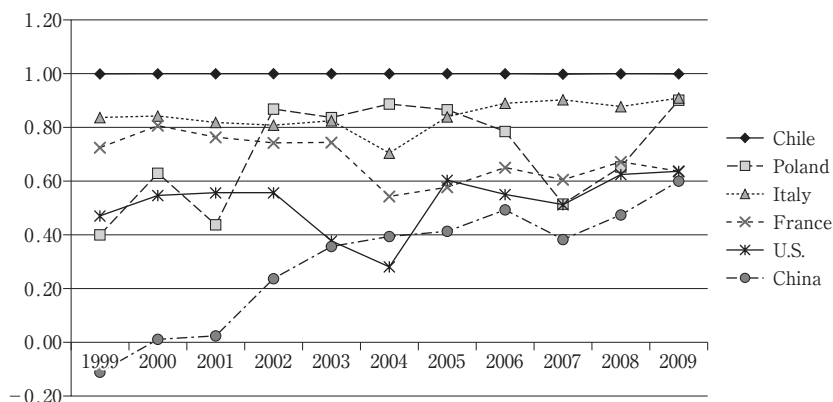
Source: Calculated by author from FAOSTAT

tively. France had a strong competitive advantage with the average TC index of 0.68, but showed the downward trend in competitive advantage declining from 0.72 in 1999 to 0.68 in 2009. China is the only country that had an unfavorable balance of apple trade between 1999 and 2009. The TC index of China in 1999 is negative (−0.11), indicating that China's apple industry are in a situation of competitive disadvantage. After 1999, China's TC index showed a rapidly increasing trend in competitive advantage rising from 0.01 in 2000 to 0.60 in 2009. However, the competitive advantage of China's apple industry still falls behind the United States, France, Italy, Chile, and Poland.

IV　Factors Affecting Competitiveness

From the above competitiveness analysis between 1999 and 2009, China's apple industry has undergone rapid growth and maintained a strong competitive position. However, China still falls behind other major apple producing countries, such as the United States, France, Italy, Chile, and Poland. The Chinese apple industry is competitive in export markets primarily because of its low production costs and exports price. Nonetheless, other factors, such as low quality and industry structure, restrict its ability to compete in the global apple market.

（1）Cost and Price

Low production cost provides Chinese apple producers primary competitive advantage. The total cost to produce apples in Italy was $7,787 per acre, more than five times the China's production cost（$1,545 per acre）（Table 5）. Apples exported from the United States（$933/Tonne）, France（$966/Tonne）, and Italy（$910/Tonne）receives prices almost 1.5 times higher than Chinese apple（$608/Tonne）（Table 6）. However, rising costs and commodity price inflation may constrain China's export growth. Farm labor costs are rising

Table 5 Production Costs for in Selected Countries（Dollar/acre）

Country	Labor	Materials	Direct Costs	Overhead	Total Costs
Italy	2,753	736	3,489	4,298	7,787
France	2,288	492	2,780	2,615	5,395
USA	2,052	450	2,502	2,502	5,004
Chile	1,045	406	1,450	1,179	2,629
Poland	325	348	672	1,169	1,842
China	374	587	961	584	1,545

Source: Statement of Nancy Foster, president and CEO of the U.S. Apple Association, 2005[6]

Table 6 Apple Export Unit Values in Selected Countries（$/Tons）

	France	U.S.	Italy	Chile	China	Poland
1999	584	583	476	412	346	202
2000	502	586	419	438	324	152
2001	583	576	477	384	332	112
2002	707	637	536	510	341	151
2003	761	667	662	441	344	194
2004	915	780	799	457	354	247
2005	775	729	666	475	372	278
2006	837	860	789	526	463	312
2007	994	982	952	713	503	406
2008	1,127	1,052	1,202	728	606	516
2009	966	933	910	733	608	361
Average	796	762	717	529	418	266

Source: FAOSTAT

as much as 10 percent annually as rural labors migrate to cities（USDA[7]）. With increasing cost of producing apples, Chinese apple will have a small comparative advantage in the international apple market.

（2）　Product Quality and Technology

Although the apple yields in China have increased through technological improvements in the past few years, productivity is still low when compared with other major apple producing counties. Product quality is also a key factor affecting the international competitiveness. The flavor, appearance, size, shelf life, and overall condition of Chinese apples are restricted by traditional methods of irrigation, fertilization, and farm management. Transportation, storage and adequate pest and disease control are challenges to guarantee the safety and quality that China's apple industry has to face. Therefore, the Chinese apple industry should improve the apple quality and provide high quality apples to compete with other countries in the higher income segment of export markets.

（3）　Industry Structure

The structure of the Chinese apple industry consists of millions of small apple producers,

and the average apple farm size is between 1.5 and 2.5 acres（USITC[8]）. The structure in the United States is characterized by orchards on plots of several hundred hectares, and the average size of an orchard is about 50 acres. The small scale of apple production in China results in inefficient supply chains involving high transaction and distribution costs compared to other major apple producing countries that are able to achieve significant benefits through economies of scale. This structure weakens China's competitiveness in the global apple markets.

V Conclusion and Implication

Although China is the world's largest producer and exporter of apples by volume in the world, and the international competitiveness has been improved significantly in the past few years, it still falls behind traditional strong competitors such as Chile, the United States, France, and Italy. Especially according to the TC and RCA index, Chile has the strongest competitiveness in selected countries with only 2% of world's apple production. China and Poland have gained market share of total world apple exports, while the United States, Chile, Italy and France has dropped in market share of total world apple exports.

However, there are some challenges to limit the competitiveness of the Chinese apple industry, such as increasing cost, quality and safety, productivity, etc. The major problem lies in the structure of small-scale production. Small-scale production makes it more difficult to produce homogeneous products, ensure the quality and safety, meet standards of high income consumers, and achieve the economies of scale by reducing transaction costs. Therefore, the Chinese industry should continue to improve the quality of its production by upgrading its orchard management techniques and post-harvest treatment in order to expand their market share in some high-income countries. On the other hand, farmers' co-operatives should be established in the Chinese apple industry to combat the inefficiencies associated with the current farm structure, because the farmers' cooperatives can facilitate small scale farmers' access to input and product markets, and assume several functions （such as collection, grading, post-harvest and storage） in the food supply chain to guarantee quality and safety.

Reference

1） Food and Agriculture Organization of the United Nations （FAO）. FAOSTAT Database.

　　Available on the website http://faostat.fao.org/site/291/default.aspx

2）　Belrose, Inc. World Apple Review 2009 Edition. Pullman, WA: Belrose, 2009.

3）　Huang, Sophia and Fred Gale, "China's Rising Profile in the Global Market for Fruits and Vegetables." Amber Waves, 4 (2), 2006. Available at http://www.ers.usda.gov/AmberWaves/ April06/DataFeature/.

4）　Balassa, B. "Trade liberalization and revealed comparative advantage", Manchester School of Economic and Social Studies, 33, 1965, pp. 99–124.

5）　Greenaway, D. and C. Milner, "Trade and industrial policy in developing countries", Macmillan, London, 1993.

6）　Foster, N., "Statement of Nancy E Foster President and CEO US Apple Association, US-China Economic and Security Review Commission", Washington, 4 February, 2005.

7）　United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS), "Chinese Agricultural Exports Provide Growing Competition," February 3, 2011.

8）　U.S. International Trade Commission (USITC), "Apples: Industry and Trade Summary", USITC Publication ITS-04, Washington, DC 20436, 2010.